

## CLAIMS

What is claimed is:

1. A shaft seal assembly comprising:  
  
a case;  
  
an elastomeric seal body molded to the case;  
  
a lip portion extending from the seal body, originating in a hinge portion;  
  
and  
  
a liner attached to the lip portion.
  
2. The shaft seal assembly specified in claim 1 wherein:  
  
the case includes a radial portion having a length;  
  
the seal body includes a radial portion having a length less than the length  
of the radial portion of the case; and  
  
the lip portion extends over at least a portion of the length of the radial  
portion of the case.
  
3. The shaft seal assembly specified in claim 2 wherein the lip portion  
is integrally formed with the seal body and extends over the length of the radial  
portion of the case of which the radial portion of the seal body does not extend.
  
4. The shaft seal assembly specified in claim 1 wherein the line is  
bonded to the lip portion.

5. The shaft seal assembly specified in claim 1 wherein the lip portion includes hydrodynamic grooves.

6. A seal assembly including:  
a case having a radial portion;  
a seal body molded to the case and not covering the entire radial portion of the case;  
a lip portion extending from the seal body and covering the radial portion of the case not covered by the seal body; and  
a liner attached to the lip portion.

7. The seal assembly specified in claim 6 wherein material of the lip portion adjacent the seal body and the radial portion of the case forms a flexible hinge.

8. The seal assembly specified in claim 7 wherein the liner is formed from polytetrafluoroethylene.

9. The seal assembly specified in claim 8 wherein the liner includes a contact surface.

10. The seal assembly specified in claim 9 wherein the contact surface includes at least one hydrodynamic groove.

11. The seal assembly for use with a rotating element, comprising:  
a case having an axial portion and a radial portion;  
a seal body bonded to at least the radial portion of the case;  
a hinge bonded to the seal body adjacent to a terminating section of the radial portion of the case;  
a lip bonded to the hinge; and  
a liner attached to the lip.

12. The seal assembly specified in claim 11 wherein the seal body, the hinge, and the lip are integrally bonded together.

13. The seal assembly specified in claim 11 wherein the seal body, the hinge, and the lip are formed from an elastomeric material.

14. The seal assembly specified in claim 11 wherein the liner is formed from polytetrafluoroethylene.

15. The seal assembly specified in claim 11 wherein the liner includes at least one groove.

16. The seal assembly specified in claim 11 wherein the radial portion of the case has a length that is greater than a radial length of the seal body.

17. The seal assembly specified in claim 16 wherein the hinge extends over the radial portion of the case that is not covered by the seal body.

18. The seal assembly specified in claim 11 wherein the liner is bonded to the lip.

19. The seal assembly specified in claim 11 wherein the hinge receives more bending stresses than the liner.

20. The seal assembly specified in claim 11 wherein the lip receives more bending stresses than the liner.